



US Army Corps
of Engineers®
Nashville District

**REALLOCATION REPORT FOR WATER
SUPPLY STORAGE ON CENTER HILL
RESERVOIR, TENNESSEE:
CITY OF COOKEVILLE, TN;
CITY OF SMITHVILLE, TN;
DEKALB UTILITY DISTRICT, TN;
AND RIVERWATCH RESORT, LLC.**

prepared by
Nashville District, Corps of Engineers
Hydrology and Hydraulics Branch

NOVEMBER 2001

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ATTACHMENTS

1. Correspondence with Water Supply Users - The City of Cookeville, Tennessee; the City of Smithville, Tennessee; DeKalb Utility District, Tennessee; and RiverWatch Resort, LLC
2. Hydrology and Hydraulics
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5. Correspondence with Federal and State Agencies and Southeastern Power Administration (SEPA)
6. Public Notice

**REALLOCATION REPORT FOR WATER SUPPLY STORAGE ON
CENTER HILL RESERVOIR, TENNESSEE:**

**CITY OF COOKEVILLE, TN;
CITY OF SMITHVILLE, TN;
DEKALB UTILITY DISTRICT, TN;
RIVERWATCH RESORT, LLC.**

NOVEMBER 2001

1.0. PURPOSE

1.1. This reallocation report is prepared to bring existing users (the City of Cookeville, Tennessee, and the City of Smithville, Tennessee) into compliance with the Water Supply Act of 1958. In addition, this report is prepared in response to requests (Attachment 1) from the DeKalb Utility District, Tennessee and RiverWatch Resort, LLC. for withdrawals of 4.0 and 0.392 million gallons per day (mgd), respectively. Water supply storage has been calculated for the following future (projected to 2009, a reasonable time into the future to estimate water supply usage) withdrawals:

Water Supply User	Withdrawal from Center Hill	Return Flow into Center Hill
City of Cookeville	20.000 mgd	13.650 mgd
City of Smithville	1.200 mgd	1.560 mgd ¹
DeKalb Utility District	4.000 mgd	0.050 mgd
RiverWatch Resort, LLC	0.392 mgd	0.000 mgd
Anticipated New Users	2.559 mgd ²	0.000 mgd
TOTAL	28.151 mgd	15.260 mgd

1.2. This report is prepared in accordance with Engineer Regulation 1105-2-100. Authority for the reallocation of storage is provided by PL 85-500, 1958 River and Harbor Act, 3 July 1958.

¹ The City of Smithville returns more flow to Center Hill Reservoir than it withdraws due to groundwater infiltration.

² Storage reallocated to meet future water supply needs of new users or increases by existing users.

2.0. BACKGROUND OF CENTER HILL RESERVOIR

2.1. Center Hill Dam is located at Mile 26.6 on the Caney Fork, a tributary of the Cumberland River, in the central portion of Middle Tennessee. Center Hill Reservoir extends 64.5 miles upstream to Great Falls Dam, a TVA hydropower dam. Center Hill Dam and reservoir are located in DeKalb, Warren, and White Counties, Tennessee. The project was constructed for the primary purposes of hydroelectric power and flood control. Secondary purposes include recreation, fish and wildlife management, and water quality.

2.2. The Center Hill Reservoir project was authorized under the Flood Control Act of 28 June 1938 (Public Law 761, 75th Congress and the River and Harbor Act of 24 July 1946 (Public Law 525, 79th Congress.)

2.3. Center Hill Reservoir is a unit in the comprehensive plan for the development of the Cumberland River Basin (see Figure 1). Related improvements include nine existing multiple purpose projects; Barkley, Cheatham, Old Hickory, Cordell Hull, and Wolf Creek (Lake Cumberland) on the main stem; Dale Hollow on the Obey River; J. Percy Priest on the Stones River; Martins Fork on the Martins Fork of the Clover Fork; and Laurel River on the Laurel River.

2.4. In the project document plan, the Center Hill Reservoir project was designed for flood control and hydropower as an integral unit of the coordinated plan for the development of the water resources of the Cumberland River Basin (see Figure 1). The plan of improvement incorporated 762,000 acre-feet of flood control storage and is used to protect the City of Carthage, Tennessee and other points downstream including the primary damage center of Nashville, Tennessee. The originally conceived project was of a combination concrete gravity and rolled earthfill dam, approximately 2,495 feet in length, and raising about 250 feet above its lowest foundations. A controlled, ogee type, concrete gravity spillway was located 245 feet from the right bank on the concrete portion, consisting of 8 tainter gates (37 feet by 50 feet), 470 feet in length, discharging into the main riverbed at the base of the project site. A powerhouse of conventional indoor type, with an installation of three 45 megawatt generators, was situated directly at the downstream toe of the dam. At the top of the flood control pool, spillway crest elevation

685, the reservoir would cover an area of 23,060 acres. It provides a total storage capacity of 2,092,000 acre-feet.

2.5. Construction of the project started 18 March 1942, but work was suspended from March 1943 to January 1946 due to World War II. Dam closure was started 27 November 1948 and was completed December 1949. The first power unit was placed in commercial production in December 1950. A map is provided, as Figure 1, which shows the reservoir location.

2.6. The reservoir is operated in such a manner that maximum overall project benefits are realized. It is normally operated within the hydropower pool limits, between elevations 618.0 and 648.0. The top of the power pool will be exceeded occasionally during high water periods, usually occurring in the winter and spring months. Flows will enter into the flood control pool, which provides 762,000 acre-feet of storage, or pass downstream if conditions allow it. During the history of the project, the pool has been within the range of the power pool over 92 percent of the time and within the flood control pool about eight percent of the time. The pool has never been below the bottom of the hydropower pool.

2.7. A pertinent data table is included as Table 1 and storage features as Table 2.

TABLE 1

CENTER HILL DAM & RESERVOIR PERTINENT DATA

DAM LOCATION

- Dam Location

State:	Tennessee
County:	DeKalb
Nearest Communities:	City of Gordonsville, located 11 miles west of the project and the City of Carthage, located 14 miles northwest of the project
River:	Caney Fork
Mile:	26.6
Latitude:	North 36° 05' 48"
Longitude:	West 85° 49' 38"

- Adjacent Water Control Facilities

Upstream	Great Falls Dam: Caney Fork River, Mile 91.1
Downstream	Old Hickory Dam: Cumberland River, Mile 216.2

ORIGINAL AUTHORIZATION & HISTORY

- | | |
|--------------------------|---------------------------------------|
| Primary Project Purposes | -Authorizing Legislation- |
| Flood Control | PL 75-761, Flood Control Act of 1938 |
| Hydropower | PL 79-525, River & Harbor Act of 1946 |
-
- Additional Operating Purposes

Recreation	PL 78-534, Flood Control Act of 1944
Fish & Wildlife	PL 85-624, Fish & Wildlife Coordination Act of 1958
Water Quality	PL 92-500, Federal Water Pollution Control Act
	Amendments of 1972
Water Supply	Although storage space is not allocated for water supply on either a permanent (PL 85-500) or temporary (PL 78-534) basis, water is being withdrawn for municipal and industrial purposes. Consequently, during drought, consideration is given to keeping the reservoir level above the supply pipe intakes.

 - Construction Dates

Began	-	18 Mar 42
Suspended due to WWII	-	Mar 43
Work resumed	-	Jan 46
Closure	-	27 Nov 48
Impoundment	-	11 Jan 49
Inservice		
Power		
Unit 1	-	16 Dec 50
Unit 2	-	17 Jan 51
Unit 3	-	11 Apr 51

Table 1 – Continued

PHYSICAL COMPONENTS OF DAM

• Type of Structure			
Combination concrete gravity & rolled earthfill embankment			
• Dam Section Lengths			
Spillway Section, Concrete	-	470 ft	143.2 m
Power Section, Concrete	-	267 ft	81.4 m
Left Side Non-overflow Section, Concrete	-	400 ft	121.9 m
Right Side Non-overflow Section, Concrete	-	245 ft	74.7 m
Embankment Section, Rolled Earthfill	-	<u>778 ft</u>	<u>237.1 m</u>
Total Dam Length	-	2160 ft	658.3 m
• Structure Elevations			
Top of Dam, Roadway & Embankment	-	696 NGVD	212.1 m
Top of Gates	-	685 NGVD	208.8 m
Spillway Crest	-	648 NGVD	197.5 m
Flood Plain, General Elevation	-	510 NGVD	155.4 m
Minimum Tailwater, Zero Flow	-	476 NGVD	145.1 m
Stream Bed, approx.	-	470 NGVD	143.2 m
Base of Dam, Concrete Section, approx.	-	446 NGVD	135.9 m
• Outlet Works			
Spillway			
Type - Concrete Gravity, Ogee, with Bucket			
Stilling Basin			
Total Effective Width	-	400 ft	121.9 m
Tainter Gates			
Number	-	8	
Width	-	50 ft	15.2 m
Height	-	37 ft	11.3 m
Design Discharge	-	458,000 cfs	12,970.6 cms
(with surcharge of 43.4 ft)			
Sluices			
Type - Cast Iron, Slide, Hydraulically Operated			
Number	-	6	
Width	-	4 ft	1.22 m
Height	-	6 ft	1.83 m
Discharge Capacity	-	9,600 cfs	271.9 cms
(pool @ spillway crest)			
• Saddle Dam (about 0.5 mile east of main dam)			
Type - Rolled-fill Dike			
Top of Dam	-	696.6 NGVD	212.3 m
Maximum Height	-	125 ft	38.1 m
Top Length	-	770 ft	234.7 m
Top Width	-	35 ft	10.7 m
Maximum Base Width	-	600 ft	182.9 m

Table 1 - Continued

• Power Plant			
Type - 3 Francis turbines			
Operating Heads			
Maximum with full flood control pool	-	207 ft	63.1 m
Nominal (normal for design)	-	160 ft	48.8 m
Minimum with full drawdown	-	131 ft	39.9 m
Penstock			
Number	-	3	
Diameter	-	20 ft	6.1 m
Discharge at Full Rating,	-	3,750 cfs ea	106.2 cms
50,000 kva, 160-ft head	-	(11,250 cfs tot)	318.6 cms
Nameplate Power Rating	-	45 MW ea	
		(135 MW tot)	
Estimated average annual generation	-	351,000 MWH	

HYDRAULICS & HYDROLOGY

• Drainage Areas			
Project			
Total	-	2,174 sq mi	5,630 sq km
Local Uncontrolled	-	499 sq mi	1,292 sq km
(between Center Hill and Great Falls)			
Control Point - Carthage, Tennessee			
Total	-	10,690 sq mi	27,684 sq km
Local Uncontrolled	-	420 sq mi	1,088 sq km
(between Carthage & Cordell Hull & Center Hill)			
Downstream Project - Old Hickory			
Total	-	11,674 sq mi	30,233 sq km
Local Uncontrolled	-	1,404 sq mi	3,636 sq km
(between Old Hickory & Cordell Hull & Center Hill)			
• Top of Pool Elevations			
Flood Control	-	685.00 NGVD	208.8 m
Hydropower	-	648.00 NGVD	197.5 m
Inactive	-	618.00 NGVD	188.4 m
• Surface Area at top of pools			
Flood Control	-	23,060 acres	9,335 hectares
Hydropower	-	18,220 acres	7,376 hectares
Inactive	-	14,590 acres	5,947 hectares
• Length of Reservoir at top of pools			
Flood Control	-	64.0 mi	103.0 km
Hydropower	-	63.6 mi	102.3 km
Inactive	-	62.4 mi	100.4 km

Table 1 - Continued

- Shoreline length at top of pool
Flood Control - 415 mi 667.8 km
- Storage Volumes (Ac-ft) Cu hm
 - Flood Control - 762,000 940
 - Hydropower - 492,000 607
 - Inactive - 838,000 1,034
 - Total - 2,092,000 2,581
- Day Second Ft (dsf)
 - Flood Control - 384,000
 - Hydropower - 248,000
 - Inactive - 421,000
 - Total - 1,054,000
- Runoff (in) cm
 - Flood Control - 6.51 16.5
 - Hydropower - 4.21 10.7
 - Inactive - 7.16 18.2
 - Total - 17.88 45.4
- Average Outflows (1951 - 1996)

Month	Generation	Spill	Total (cfs)	Total (cms)
Jan	6061	345	6504	181
Feb	5598	490	6087	172
Mar	5902	746	6648	188
Apr	5805	636	6441	182
May	3607	152	3759	106
Jun	2613	33	2646	75
Jul	1853	0	1853	52
Aug	1679	0	1679	48
Sep	1471	0	1471	42
Oct	1834	0	1834	52
Nov	2297	54	2350	67
Dec	4742	87	4830	137
Annual	3613	210	3823	108

REAL ESTATE

- Acquisition Ha
 - Fee Holdings - 38,551 ac 15,606.7
 - Easement Holdings (above the dam)- 102 ac 41.3
 - (below the dam)- 427 ac 172.9
- Elevation of Acquisition Line
 - Elevation 690 plus additional lands deemed necessary to avoid paying excessive severance or incidental damages due to isolation.

ACCESS LOCATIONS

	<u>Reservoir Sailing Line (Mile)¹</u>	
• Bridge Crossings		
TN Highway 96	26.6	(at dam)
TN Highway 56	37.9	
U.S. Highway 70	47.5	
		<u>Bank</u>
• Recreation Areas		(looking downstream)
Corps of Engineers		
Long Branch	26.0	L
Buffalo Valley	26.2	R
Center Hill Park	26.7	L
Cove Hollow	28.6	L
Holmes Creek	31.6	L (Holmes Creek)
Floating Mills	35.1	R
Hurricane Bridge	36.6	R
Johnson Chapel	44.1	R (Falling Water River)
Ragland Bottom	45.8	R
By Others		
Edgar Evans State Park	29.6	L & R
Burgess Falls State		
Natural Area	44.1	R (Falling Water River)
Rock Island State Park	89.0	L & R
Commercial Boat Docks		
Center Hill Marina	28.6	L
Holmes Creek Marina	31.6	L (Holmes Creek)
Hurricane Marina	36.4	R
Cookeville Marina	44.1	R (Falling Water River)
Sligo Marina	48.1	L
Four Seasons Marina	51.1	L
Pates Ford Marina	63.1	L

¹ The reservoir mile represents a much more direct path than the river mile of the old channel. Since recreation areas generally exceed one mile in length, the reservoir mile given is about at the midpoint of the area.

TABLE 2
CENTER HILL RESERVOIR, TENNESSEE – STORAGE FEATURES

Feature	Elevation (ft. NGVD)	Existing Storage¹ (ac. ft.)	Existing Storage (percent)	Proposed Total Storage (ac. ft.)	Proposed Total Storage (percent)	Existing Usable Storage² (ac. ft.)	Existing Usable Storage (percent)	Proposed Usable Storage³ (percent)
Flood Control	685.0	762,000	36.4	762,000.0	36.42	762,000	60.77	60.77
Hydropower	648.0	492,000	23.5	482,599.0	23.07	492,000	39.23	38.48
Inactive Pool	618.0	838,000	40.1	838,000.0	40.06			
Water Supply	0.5 ⁴			9,401.0	0.45			0.75
Total Storage	685.0	2,092,000	100.00	2,092,000.0	100.00	1,254,000	100.00	100.00

¹ Includes storage for sedimentation and hydropower head

² Usable storage does not include storage for sediment distribution or for hydropower head. The sedimentation rate at Center Hill Reservoir from June 1963 to October 1986 was 0.50 acre-foot/square mile/year. During a 100 year period, 108,700 acre-feet would be deposited within the reservoir between elevations 618 and 470. At the end of 100 years, this 108,700 acre-feet would represent 13.0 percent of the inactive storage and 5.2 percent of the total storage. Inactive storage for the hydropower head is 729,300 acre-feet (838,000 acre-feet – 108,700 acre-feet = 729,300 acre-feet). Total usable storage is 1,254,000 acre-feet (2,092,000 acre-feet – 838,000 acre-feet = 1,254,000 acre-feet).

³ Percent of the storage available for all project purposes less storage for sedimentation and storage of hydropower.

⁴ Storage between elevation 648 and 618 sufficient for the City of Cookeville, TN; the City of Smithville, TN; the DeKalb Utility District, TN; the Riverwatch Resort, LLC; and anticipated new users.

3.0. BACKGROUND OF WATER SUPPLY INTAKES

3.1. The City of Cookeville

3.1.a. The City of Cookeville currently withdraws 10.8 mgd from Center Hill Reservoir. It plans on withdrawing 20.0 mgd by the year 2009. The City of Cookeville has a wastewater treatment plant that returns effluent to Center Hill Reservoir. The City of Cookeville also sells some of its treated water to the City of Baxter. The City of Baxter has its own wastewater treatment plant, which returns its water back to Center Hill Reservoir. Together, the two cities expect to return 13.65 mgd back to Center Hill Reservoir in 2009.

3.1.b. On 20 August 1969, the Secretary of the Army granted an easement (No. DACW62-2-70-57) to the City of Cookeville, Tennessee for the right-of-way for the installation, operation, and maintenance of a thirty-inch water intake line and related electric and telephone lines within the Center Hill Dam and Reservoir Project. The intake is located on the Lick Creek embayment of Center Hill Reservoir.

3.1.c. On 1 March 1973, the City of Cookeville entered into a contract with the United States of America to withdraw water from Center Hill Reservoir pursuant to Contract DACW62-73-C-0072. The contract was executed under the authority of Section 501 of the Independent Offices Appropriations Act of 1952 (31 U.S.C. 9701). Based upon ER 1105-2-100, 4-31-d, the contract was allowed to expire under the terms set therein. Over a 25-year period, the City of Cookeville has paid \$98,167.93. The city requests that the \$98,167.93 plus interest calculated against the payments that were received be taken into consideration when the storage fees are calculated.

3.1.d. Recently the City of Cookeville requested permission to expand their raw water intake and install a second thirty-inch water intake line from the Lick Creek embayment to the city's water treatment plant. The additional intake will increase the water plant capacity to 20.0 mgd.

3.2. The City of Smithville

3.2.a. The City of Smithville currently withdraws 1.3 mgd from Center Hill Reservoir. It plans on withdrawing 1.2 mgd from Center Hill Reservoir by the year 2009. The decrease is due to the potential loss of the DeKalb Utility District as a customer if it completes its own water treatment plant. The City of Smithville expects to return 1.56 mgd of treated water back to Center Hill Reservoir. The city returns more water than it withdraws due to groundwater infiltration.

3.2.b. The City of Smithville feels that it gets no significant benefit from Center Hill Reservoir because the Caney Fork had sufficient flow to sustain the city's withdrawal without any impoundment. The only benefit the city claims to receive is a lower static head due to the formation of the impoundment.

3.2.c. The City of Smithville, TN was granted an easement (DACW62-2-67-283) for a water supply pipeline, water intake line, and structure at Center Hill Reservoir in February 1967. No mention is made of water supply storage. However, Mayor Edward Frazier of the City of Smithville, TN, signed (7 December 1978) the First Supplemental Agreement to the easement that contained the following language:

"It is further understood that a water services contract between the Secretary of the Army and the City of Smithville may be necessary as a result of the above-mentioned new pipeline; and the City of Smithville hereby agrees to enter into such a contract if it is necessary to do so."

3.3. The DeKalb Utility District

The DeKalb Utility District is currently purchasing its supply of potable water from the City of Smithville. It hopes to have a new water treatment plan online by the year 2009. DeKalb Utility District expects to need to withdraw 4.0 mgd by 2009. Approximately 0.05 mgd, from the backwashing of the filters, will be returned to the reservoir.

3.4. RiverWatch Resort, LLC.

RiverWatch Resort, LLC. is currently purchasing potable water from the DeWhite Utility District. The resort is building a water intake on Center Hill Reservoir for the purpose of watering its golf course. It plans on withdrawing 0.392 mgd for this purpose. RiverWatch Resort, LLC. expects that no water will be returned to the reservoir. In 1999, RiverWatch Resort, LLC. signed a surplus water contract. The surplus water contract will be terminated upon execution of the water supply storage agreement.

3.5. Anticipated New Users

In addition to the total storage recommended for water supply reallocation for Cookeville, Smithville, DeKalb Utility District, and RiverWatch Resort, LLC., the Nashville District recommends enough storage to provide a dependable yield of 2.559 mgd (ten percent of the total) be reallocated to meet future water supply needs of new users or increases by existing users.

4.0. ALTERNATIVES CONSIDERED

4.1. The City of Cookeville

The City of Cookeville, Tennessee is the largest urban area and consequently needs a large water supply source. Center Hill Reservoir replaced City Lake as the water source in the late sixties. Due to the city's growth, it would still not be able to support the city's needs. The city feels that it has no other economical alternatives.

4.2. The City of Smithville

4.2.a. The City of Smithville is located in DeKalb County. Presently, the city provides a source of potable for its residents as well as customers of the DeKalb Utility District. The city is presently withdrawing 1.3 mgd and plans on withdrawing 1.2 mgd in 2009. The City of Smithville expects to be withdrawing less water in the year 2009 if it loses the DeKalb Utility District as a customer when the utility district completes its own intake and water treatment plant.

4.2.b. Alternative 1:

The City of Smithville, Tennessee has examined using Morgan Springs as a water supply source. Testing on the springs indicate that it is either under influence of surface water (these types of streams tend to dry up during drought periods as their source of water comes from runoff) or has an inadequate capacity for the city's future needs.

4.2.c. Alternative 2:

The second alternative would be using water from Colvert Springs, Whorton Springs, Pine Springs, Cappy Springs, Fall Creek and Pine Creek. Testing on the springs indicated that they are either under influence of surface water or have inadequate capacity for future needs. An intake above the wastewater treatment plant discharge on Fall Creek would not have sufficient capacity, eliminating Fall Creek. Pine Creek was eliminated because Center Hill Reservoir was considered to be a more reliable source and more customers were located in the Center Hill Reservoir area.

4.2.d. Alternative 3:

The City of Smithville feels that its best alternative is to continue to withdraw water from Center Hill Reservoir. The City already has an intake and feels it is the most favorable site to effectively serve its customers.

4.3. DeKalb Utility District

4.3.a. As stated previously, the DeKalb Utility District is presently purchasing potable water from the City of Smithville, Tennessee. The city has indicated that it lacks sufficient infrastructure capacity to deliver additional potable water to its customers and the district. The utility district and its consulting engineer feel that it has three alternatives.

4.3.b. Alternative 1:

The first alternative is to construct a water treatment plant that will have the storage capacity of 4.0 mgd by the year 2009. The utility district has applied for and received funding from the Rural Development Agency/USDA to construct a new water treatment plant and related structures. DeKalb Utility District proposes that the intake structure to be located in the Holmes Creek cove of Center Hill Reservoir. The only return flow will consist

of backwash water from the filters. This is expected to be around 0.05 mgd.

4.3.c. Alternative 2:

The DeKalb Utility District also looked at using groundwater as an alternative water supply source. This was rejected after a more detailed analysis. The groundwater yields for the amount needed is very unreliable for the section of Tennessee in which the district is located.

4.3.d. Alternative 3:

The third alternative that the DeKalb Utility District looked at was the construction of a new dam on either the Caney Fork or Smith Fork to supply sufficient storage. This was rejected for numerous reasons. First, increasing environment pressure is against the construction of a new dam. Second, the construction of a new dam would be far more costly.

4.3.e. The DeKalb Utility District feels that an intake in Center Hill Reservoir is the one that is most economically feasible. It also allows the most growth potential for the utility district.

4.4. RiverWatch Resort, LLC.

RiverWatch, LLC. has examined an alternative source of water for the watering of the golf course. This alternative is to buy potable water from the DeWhite Water Utility District. This is not competitive when compared to the construction of the intake. Since it will be used for watering a golf course, treatment of the water is unnecessary.

5.0. WATER SUPPLY STORAGE/YIELD ANALYSIS

5.1. The impacts from water supply upon Center Hill Reservoir were measured in three ways (Attachment 2). First, the water surface elevation began to steadily decline on the same day as without water supply. Second, the lowest elevation reached during a critical drought was 0.5 feet lower than without water supply. Third, the reservoir water surface elevation returned to the top of the power pool 21 days later than without water supply.

5.2. Current elevation and storage data for Center Hill Reservoir are shown in Table 2. Hydrologic studies for water supply reallocation include the following elevations:

Top of hydropower pool	648.0 Feet
1953 drought level evaporation only	647.6 Feet
1953 drought level evaporation, water quality, hydropower, and leakage	635.2 Feet
1953 drought level evaporation, water quality, leakage, and water supply	634.7 Feet

5.3. As proposed, the 9,401 acre-feet of storage would be reallocated from the hydropower pool for water supply storage. The water supply yield from 9,401 acre-feet is based upon 28.151 mgd withdrawn and 15.26 mgd returned. Under these withdrawal and return criteria, a 1 mgd yield from Center Hill River Reservoir under 1953 drought conditions requires approximately 334 acre-feet of storage.

5.4. Initial closure of Center Hill Dam was made in November 1948. Normal operations began at Center Hill Dam January of 1949. In April 1951, the final hydropower-generating unit was placed on line for commercial operation, which completed the final phase of construction. The minimum headwater since closure of the project is an elevation of 618.0, which occurred in January 1956.

5.5. A recommended invert elevation is 614.6 feet for water supply intakes. This is based on the maximum number of acre-feet (50,000 af) that the U.S. Army Corps of Engineers can reallocate without Congressional approval. The bottom of the power pool, 618.0, is used as the starting elevation for this determination.

5.6. This method of reallocating hydropower storage for water supply at Center Hill does not affect the approved operational criteria. Hydrologic studies show that reallocating 9,401 acre-feet in this manner does not have serious impacts on any of the authorized project purposes. The minimum pool elevation recorded at the project was 618.0, which still provides sufficient depth for water supply intakes.

6.0. COST OF HYDROPOWER BENEFITS FOREGONE, REVENUES FOREGONE, AND REPLACEMENT COSTS

6.1. Pertinent hydropower data was sent to the U.S. Army Corps of Engineers, Northwest Division, North Pacific Regional Office, Mandatory Center of Expertise for Hydropower System-Economic Evaluation, for determination of hydropower benefits foregone, revenues foregone, and replacement costs for Center Hill Reservoir. Replacement cost is an economic or National Economic Development (NED) cost, and is therefore a redundant value in the case of hydropower. This is because the NED power benefits foregone are based on the cost of the most likely alternative, which in fact is the cost of replacement power. Replacement cost is included in the guidance as one of the four alternatives to be evaluated because it has meaning when storage is reallocated from other functions other than hydropower. The tables are included as Attachment 3. The below costs are calculated based on 2001 cost.

Project	Withdrawal (MGD)	Capacity Benefits Foregone	Energy Benefits Foregone	Total Benefits Foregone
Center Hill	1.00	\$6,019	\$4,723	\$10,742
Old Hickory	1.00	\$802	\$1,453	\$2,255
Cheatham	1.00	\$337	\$607	\$944
Barkley	1.00	\$439	\$1,167	\$1,606
Total Benefits Foregone		\$7,597	\$7,950	\$15,547

2000	Withdrawal (MGD)	Capacity Revenues Foregone	Energy Revenues Foregone	Total Revenues Foregone
Center Hill	1.00	\$2,096	\$1,155	\$3,251
Old Hickory	1.00	\$279	\$380	\$659
Cheatham	1.00	\$117	\$161	\$278
Barkley	1.00	\$153	\$312	\$465
Total Revenues Foregone		\$2,645	\$2,008	\$4,653

Hydropower benefits foregone = \$ 15,547/year

Hydropower revenues foregone = \$ 4,653/year

6.2. The amount for the water storage is based upon the highest cost unless the user is eligible for a reduced price. Based on the higher of hydropower benefits foregone, the present day benefits foregone for 1 mgd

(based on a 50-year life of the project at an interest rate of 6.375%) is \$240,083 as shown in Table 3.

Table 3.

**Present Day Benefits Foregone for
Hydropower, Center Hill Reservoir**

Interest Rate: 6.375%

Present Value = Power Loss/(1+Interest Rate)*(Year-0.5)

Year	Power Loss	Present Value		Year	Power Loss	Present Value
1	\$ 15,547	\$ 15,074		26	\$ 15,547	\$ 3,215
2	15,547	14,171		27	15,547	3,023
3	15,547	13,321		28	15,547	2,842
4	15,547	12,523		29	15,547	2,671
5	15,547	11,772		30	15,547	2,511
6	15,547	11,067		31	15,547	2,361
7	15,547	10,404		32	15,547	2,219
8	15,547	9,780		33	15,547	2,086
9	15,547	9,194		34	15,547	1,961
10	15,547	8,643		35	15,547	1,844
11	15,547	8,125		36	15,547	1,733
12	15,547	7,638		37	15,547	1,629
13	15,547	7,180		38	15,547	1,532
14	15,547	6,750		39	15,547	1,440
15	15,547	6,346		40	15,547	1,354
16	15,547	5,965		41	15,547	1,272
17	15,547	5,608		42	15,547	1,196
18	15,547	5,272		43	15,547	1,125
19	15,547	4,956		44	15,547	1,057
20	15,547	4,659		45	15,547	994
21	15,547	4,380		46	15,547	934
22	15,547	4,117		47	15,547	878
23	15,547	3,870		48	15,547	826
24	15,547	3,638		49	15,547	776
25	15,547	3,420		50	15,547	730

Total = \$ 240,083

6.3. Lump Sum Cost - City of Cookeville, TN (based on withdrawing 20.0 mgd and returning 13.65 mgd)

$$6.35 \text{ mgd} \times \$240,083/\text{mgd} = \$1,524,527$$

6.4. The City of Smithville, TN does qualify as a low-income community. According to the 1990 Census, DeKalb County ranks 2,322 out of 3,141 counties in the United States based on per capita income. In addition, the City has requested 1.2 mgd out of a maximum of 2 mgd. Finally, the City of Smithville services less than 5,000 users and has a total population for the county of 15,474 out of a maximum of 20,000. Based on the above, the city is eligible for a reduced price in accordance with Section 322 of the Water Resource Development Act of 1990. The reduced price is based upon storage. If a user is eligible for a reduced price, the fee is based upon the higher of hydropower benefits foregone or updated cost of storage at the reduced price. Based on hydropower benefits foregone with 1.56 mgd, the amount per year per mgd for Smithville is \$0.

Lump Sum Cost - City of Smithville, TN (based on withdrawing 1.20 mgd and returning 1.56 mgd)¹

$$0.00 \text{ mgd} \times \$240,083/\text{mgd} = \$0$$

6.5. Lump Sum Cost - DeKalb Utility District (based on withdrawing 4.00 mgd and returning 0.05 mgd)

$$3.95 \text{ mgd} \times \$240,083/\text{mgd} = \$948,328$$

6.6 Lump Sum Cost - RiverWatch Resort, LLC. (based on withdrawing 0.392 mgd and returning 0.000 mgd)

$$0.392 \text{ mgd} \times \$240,083/\text{mgd} = \$94,113$$

7.0 COST OF STORAGE

7.1. Determination of the cost to the City of Cookeville, DeKalb Utility District, and RiverWatch Resort, LLC. for the requested water storage space is initially made by the "Use of Facilities Method," shown in Table 4, using the updated construction cost. Table 5 shows how the construction cost accounts of the project are updated to current price levels. The construction cost accounts are updated to First Quarter 2001 price levels by the use of the "Civil Works Construction Cost Index System" (CWCCIS), March 2001. Land and damage costs are updated by a weighted average based on CWCCIS factors.

¹ The City of Smithville, TN returns more than it withdraws due to infiltration of its pipeline by groundwater.

7.2. Section 932 of the 1990 Water Resources Development Act (104 Stat. 4643, 33 U.S.C. 2324) authorized, at the discretion of the Assistant Secretary of the Army, Civil Works, a reduced price of water for low-income communities. The City of Smithville, TN meets the criteria set established in this act. The price is the higher of hydropower benefits foregone or the updated cost of storage, but not to exceed (for fiscal year 1991) \$100 per acre-foot of storage space. In this case, the updated cost of storage is the higher of the two.

Table 4.

**USE OF FACILITIES METHOD
CENTER HILL RESERVOIR, TENNESSEE
ALLOCATIONS OF COSTS FOR WATER SUPPLY**

A.	Total Actual Joint-User Costs	\$29,285,518
B.	Total Updated Joint-Use Costs	\$527,608,866
C.	Amount of Acre-Feet per MGD	334 af/mgd
	9,401 af/28.151 mgd (total for all users) = 334 af/mgd	
D.	Lump Sum Cost - City of Cookeville, TN =	\$2,812,155
	20.0 mgd x 334 acre-feet/mgd = 6,680 acre-feet	
	6,680 acre-feet / 1,254,000 acre-feet = 0.533%	
	0.533% x \$527,608,866 = \$2,812,155	
E.	Lump Sum Cost - City of Smithville, TN =	\$52,932
	1.2 mgd x 334 acre-feet/mgd = 401 acre-feet	
	Cost Allocated to Water Supply in accordance with Section 322 of the Water Resource Development Act of 1990:	
	$\$100 \times \frac{175.8(\text{Feb } 2001 \text{ CPI-U})}{132.7(\text{Sep } 1990 \text{ CPI-U})} = \$132/\text{acre-foot}$	
	401 acre-feet x \$132/acre-foot = \$52,932	
F.	Lump Sum Cost - DeKalb Utility District =	\$564,541
	4.0 mgd x 334 acre-feet/mgd = 1,336 acre-feet	
	1,336 acre-feet / 1,254,000 acre-feet = 0.107%	
	0.107% x \$527,608,866 = \$564,541	
G.	Lump Sum Cost - RiverWatch Resort, LLC. =	\$52,760
	0.392 mgd x 334 acre-feet/mgd = 131 acre-feet	
	131 acre-feet / 1,254,000 acre-feet = 0.010%	
	0.010% x \$527,608,866 = \$52,760	

H. **Amount left for future water supply needs =** 2.559 mgd

$$2.559 \text{ mgd} \times 334 \text{ acre-feet/mgd} = 853^1 \text{ acre-feet}$$

I. Procedure for Calculating Annual Operation and Maintenance (O&M) Cost for Water Supply:

$$\begin{aligned} \text{Annual O\&M Payment (Water Supply)} &= \text{Actual Experienced} \\ \text{FY00 Joint-Use O\&M Cost} &= \$1,859,960^2 \end{aligned}$$

City of Cookeville, TN

$$\begin{aligned} \text{O\&M Cost for 6,680 acre-feet of storage} \\ 0.533\% \times \$1,859,960 &= \$9,914 \end{aligned}$$

City of Smithville, TN

$$\begin{aligned} \text{O\&M Cost for 401 acre-feet of storage} \\ 0.032\% \times \$1,859,960 &= \$595 \end{aligned}$$

DeKalb Utility District

$$\begin{aligned} \text{O\&M Cost for 1,336 acre-feet of storage} \\ 0.107\% \times \$1,859,960 &= \$1,990 \end{aligned}$$

RiverWatch Resort, LLC.

$$\begin{aligned} \text{O\&M Cost for 131 acre-feet of storage} \\ 0.010\% \times \$1,859,960 &= \$186 \end{aligned}$$

¹ Adjusted to account for rounding to a whole number of acre-feet in above calculations.

² Taken from the FY00 Operations and Maintenance Expenditures report for Center Hill Reservoir.

Table 5.
CENTER HILL RESERVOIR, TENNESSEE
JOINT-USE CONSTRUCTION COST UPDATING

Total joint use expenditures: \$29,285,518

Construction Started 18-Mar-42

First lands acquired

Begin of Project: 18-Mar-42 Earlier of first lands acquired or first construction contract

End of project: Impoundment 30-Sep-49 per Cost Allocation book, final closure was November 1948

Mid-point of construction 23-Dec-45 per Projects map book

	<u>Joint Use Costs</u>	<u>ENR '45</u>	<u>ENR '67</u>	<u>ENR 67 Inflator</u>	<u>Cost '67</u>	<u>CWCC '67</u>	<u>CWCC '01 Inflator</u>	<u>Cost '01</u>	
01 Lands and Damages	3,918,365	308	1,074	3.49	13,663,390	100	506.62	5.066	69,220,857
02 Relocations	2,602,949	308	1,074	3.49	9,076,517	100	522.27	5.223	47,403,925
03 Reservoir	2,366,822	308	1,074	3.49	8,253,139	100	570.54	5.705	47,087,460
04 Dam	19,947,132	308	1,074	3.49	69,555,908	100	511.51	5.115	355,785,427
06 Fish & Wildlife Facilities	0	308	1,074	3.49	0	100	502.79	5.028	0
07 Power Plant	0	308	1,074	3.49	0	100	486.77	4.868	0
08 Roads	820,000	308	1,074	3.49	2,859,351	100	522.27	5.223	14,933,531
14 Recreation Facilities	0	308	1,074	3.49	0	100	481.13	4.811	0
19 Bldgs & Grounds	250,000	308	1,074	3.49	871,753	100	481.13	4.811	4,194,266
20 Perm. Op. Equip.	76,800	308	1,074	3.49	267,803	100	481.13	4.811	1,288,479
War Suspension cost ¹	-696,550	308	1,074	3.49	-2,428,879	100	506.62	5.066	-12,305,078
30 E&D	0	308	1,074	3.49	0	100	506.62	5.066	0
31 <u>S&A</u>	<u>0</u>	308	1,074	3.49	0	100	506.62	5.066	<u>0</u>
Total	29,285,518				102,118,982				527,608,866

¹The War Suspension cost is a credit based on revenues and benefits forgone during the suspension of construction during World War II.

8.0. HYDROPOWER CREDIT TO THE SOUTHEASTERN POWER ADMINISTRATION (SEPA)

Pertinent hydropower data was sent to the Northwest Division, North Pacific Regional Office, the U.S. Army Corps of Engineers' mandatory center of expertise for hydropower system-economic evaluation, for determination of power benefits foregone, revenues foregone, and replacement costs for Center Hill Reservoir. This report is included as Attachment 3. Replacement cost of power is of two types, one is identical to the power benefits foregone as discussed in section 6.0 of this report, and the other is a cost based on actual market prices. This market based replacement cost is to be used to compute a possible credit to be given to the power marketing agency, in this case SEPA. If the water supply reallocation at Center Hill results in less hydropower being available to SEPA, then SEPA will receive a credit to offset additional costs that they might incur and to reduce their repayment obligation. The computation of these credit values is shown in Chapter 7 of the Attachment 3 for each project. The pertinent credit values presented below are calculated based on annualized capacity credit (year 2001) for a 1.0 MGD withdrawal.

PROJECT	WITHDRAWAL (MGD)	SEPA CAPACITY CREDIT	SEPA ENERGY CREDIT	SEPA TOTAL CREDIT
Center Hill	1.000	\$4,754	\$3,573	\$8,327
Old Hickory	1.000	\$629	\$1,100	\$1,729
Cheatham	1.000	\$264	\$460	\$724
Barkley	1.000	\$342	\$879	\$1,221
Total SEPA Credit		\$5,989	\$6,012	\$12,001

PROJECT	WITHDRAWAL (MGD)	SEPA CAPACITY CREDIT	SEPA ENERGY CREDIT	SEPA TOTAL CREDIT
Center Hill	10.332	\$49,118	\$36,916	\$86,034
Old Hickory	10.332	\$6,499	\$11,365	\$17,864
Cheatham	10.332	\$2,728	\$4,753	\$7,481
Barkley	10.332	\$3,534	\$9,082	\$12,616
Total SEPA Credit		\$61,879	\$62,116	\$123,995

Estimated Hydropower Credit to SEPA at Center Hill and downstream:

Total Credit from Center Hill	=	\$86,034
Total Credit from Old Hickory	=	\$17,864
Total Credit from Cheatham	=	\$7,481
Total Credit from Barkley	=	\$12,616

It should be noted that the hydropower credits given for each year would be based on the revenue actually lost or the replacement costs actually incurred and documented by SEPA. The hydropower credits are figured on a yearly basis using the hydropower report (Attachment 3).

9.0. FINANCIAL FEASIBILITY

The test of financial feasibility requires that the water supply cost, as computed for the contract, be compared to cost for the least costly alternative that the local interest would undertake in the absence of the Federal project. Because the City of Cookeville and the City of Smithville have had intakes for a number of years, the assumption is made that the use of Center Hill Reservoir is the most likely, least costly alternative for these users. The engineering consultants for DeKalb Utility District and RiverWatch Resort, LLC. analyzed several alternatives discussed above. Based on the analysis, Center Hill Reservoir is determined to be the most cost-effective alternative.

10.0. NEPA DOCUMENTATION

Attachment 4 is a final draft copy of an Environmental Assessment (EA) and includes unsigned Finding of No Significant Impact (FONSI) for this study pursuant to ER 200-2-2. The EA evaluates the effects of the proposed water supply reallocation and alternatives including "no action". This reallocation report is being circulated simultaneously for public review and for approval by the U.S. Army Corps of Engineers Headquarters in Washington. After a 30-day review period and resolution of comments, a final EA will be prepared, a FONSI will be signed, if appropriate, and both documents will replace ATTACHMENT 4 of this report.

11.0. AGENCY COORDINATION

State and federal agencies were notified through the Department of the Army permitting process, through the Public Notice/Scoping Letter for the water supply action, and through the Environmental Assessment process. Special effort was made to coordinate with the Southeastern Power Administration (SEPA). Copies of correspondence with state and federal agencies and SEPA are included as Attachment 5. Compliance with Section 106 of the National Historic Preservation Act has been achieved through coordination with the State of Tennessee.

12.0. PUBLIC COMMENT

12.1. As required by Section 5 of Public Law 100-676 (Water Resources Development Act of 1988), the District provided an opportunity for public review and comment. This was accomplished by sending a Public Notice/Scoping Letter dated January 7, 2000 (Attachment 6) to various local, state, and federal agencies.

12.2. Three letters were received regarding the Public Notice/Scoping Letter, and copies are included in Attachment 6. One letter was from the City of Cookeville requesting an increased withdrawal from 15.0 mgd to 20.0 mgd. The second letter was received from DeWhite Utility District, listed in error, instead of DeKalb Utility District, the correct user. An amended Public Notice/Scoping Letter was issued dated January 24, 2000 with Cookeville's withdrawal increased and DeKalb Utility District included. The third letter was from the State of Tennessee (after the end of the comment period) requesting full disclosure of costs and impacts of any fees from the Environmental Assessment (EA) relating to the proposed water supply reallocation. A complete copy of this report including the Environmental Assessment and the unsigned FONSI is being distributed for public and agency review to meet the State's request for full disclosure.

13.0. RECOMMENDATION

Based on the findings in this report, it is recommended that 9,401 acre-feet of storage be reallocated for water supply in the Center Hill Reservoir. Water supply storage agreements are recommended for the following users (with

specified storage reallocation) and are summarized in Table 6.

13.1. CITY OF COOKEVILLE, TN

Nashville District recommends that 6,680 acre-feet of storage be reallocated for the City of Cookeville, and the City be charged in full for storage necessary to meet its withdrawal needs. Nashville District also recommends that the City's payments, with interest, be applied to the storage fee.

(Lump Sum Cost based on updated cost of storage)

Lump Sum Cost of Storage =	\$2,812,155 - \$333,992 ¹
=	\$2,478,163
Annual O&M Cost =	\$ 9,914
Total First Year Payment =	\$2,488,077

13.2. CITY OF SMITHVILLE, TN

Nashville District recommends that 401 acre-feet of storage be reallocated for the City of Smithville, and the City be charged in full for storage necessary to meet its withdrawal needs.

(Lump Sum Cost based on updated cost of storage at the reduced price)

Lump Sum Cost of Storage =	\$52,932
Annual O&M Cost =	\$ 595
Total First Year Payment =	\$53,527

13.3. DEKALB UTILITY DISTRICT, TN

Nashville District recommends that 1,336 acre-feet of storage be reallocated for the DeKalb Utility District, and the DeKalb Utility District be charged in full for storage necessary to meet its withdrawal needs.

¹ Credit with interest (based on Water Supply Interest Rates, Enclosure 3, Economic Guidance Memorandum Number 01-02: Fiscal Year 2001 Interest Rates) for amount paid on Contract DACW62-73-C-0072.

(Lump Sum Cost based on hydropower benefits foregone)

Lump Sum Cost of Storage =	\$948,328
Annual O&M Cost =	\$ 1,990
Total First Year Payment =	\$950,318

13.4. RIVERWATCH RESORT, LLC., TN

Nashville District recommends that 131 acre-feet of storage be reallocated for RiverWatch Resort, LLC., and RiverWatch Resort, LLC. be charged in full for storage necessary to meet its withdrawal needs.

(Lump Sum Cost based on hydropower benefits foregone)

Lump Sum Cost of Storage =	\$94,113
Annual O&M Cost =	\$ 186
Total First Year Payment =	\$94,299

13.5. ANTICIPATED NEW USERS

Nashville District recommends that 853 acre-feet of storage be reallocated to meet future water supply needs of new users or increases by existing users.

STEVEN W. GAY
LTC, EN
Commanding

TABLE 6

**SUMMARY OF RECOMMENDATIONS FOR
WATER SUPPLY STORAGE AGREEMENTS,
CENTER HILL RESERVOIR, TENNESSEE**

WATER SUPPLY USER	WITHDRAWAL FROM CENTER HILL (MGD)	STORAGE REALLOCATED, ACRE-FEET	LUMP SUM COST OF STORAGE	ANNUAL O&M COST	TOTAL FIRST YEAR PAYMENT
City of Cookville, TN	20.000	6,680	\$2,478,163	\$9,914	\$2,488,077 ¹
City of Smithville, TN	1.200	401	\$ 52,932	\$ 595	\$ 53,527
DeKalb Utility District, TN	4.000	1,336	\$ 948,328	\$1,990	\$ 950,318
RiverWatch Resort, LLC.	0.392	131	\$ 94,113	\$ 186	\$ 94,299
Anticipated New Users	2.559	853 ²			
Total Storage to be Reallocated	28.151	9,401			

¹ Credit with interest (based on Water Supply Contract interest rates) for amount paid on Contract DACW62-73-C-0072.

² Adjusted to account for rounding to a whole number of acre-feet from all calculations.